Original Research Article

Microbiological study of patients with VAP admitted to ICU

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Abstract

Background: VAP is a most common nosocomial infection in the intensive care unit. Knowledge of causative organisms and their antibiotic susceptibility is crucial for diagnosis of VAP in order to initiate the appropriate antibiotic treatment thereby. **Aim:** To isolate and identify the causative organisms of VAP in ICU patients and also their resistance pattern. **Material and Methods:** All patients on mechanical ventilation for more than 48 hours were included in the study. The diagnosis of VAP was established using clinical pulmonary infection score (CPIS). Endotracheal aspirate was collected under aseptic precautions after 48 hours of intubation whenever patient was suspected to have developed VAP in ICU and was immediately taken to the laboratory for processing. **Results:** Out of the 100 cases, VAP was diagnosed in 31 cases. Thus, the incidence of VAP in our study was 31%. Out of total 24 microorganisms isolated, Klebsiella pneumoniae 13 (41.9%) was the most common organism isolated followed by Acinetobacter spp. 6 (19.3%), Pseudomonas aeruginosa 4 (12.9%). Out of the 13 Klebsiella pneumoniae isolates, 11 (84.6%) isolates of Klebsiella pneumoniae were resistant to 3rd generation cephalosporins. Among the 6 isolates of Acinetobacter spp. 4 (33.3%) were resistant to all antibiotics tested. Three Pseudomonas aeruginosa strains were resistant to Piperacillin + tazobactum, Ceftazidime, Cefepime and Ciprofloxacin. **Conclusion:** This study shows the emergence of MDR Klebsiella pneumoniae, Acinetobacter spp. and Pseudomonas aeruginosa, as potential pathogens causing VAP in our ICU. Combined clinical and microbiological prevention strategies such as rational antibiotic therapy, timely surveillance, strict infection control measures are needed to reduce incidence of VAP.

Key Word: Intensive care unit, ventilator associated pneumonia, endotracheal aspirate, multidrug resistance

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INTRODUCTION

Ventilator associated pneumonia (VAP) refers to pneumonia occurring after 48 hours of endotracheal intubation and initiation of mechanical ventilation.[1] VAP is a most common nosocomial infection in the intensive care unit (ICU). It is the leading cause of morbidity and mortality in ICU with an incidence ranging from 8 to 28% in intubated mechanically ventilated patients.[2-4] Despite the advancements in patient care, better disinfection and sterilization measures, antimicrobial regimes, VAP continues to be an important cause of morbidity and mortality. The etiologic agents widely differ according to the population of patients in an intensive care unit, duration of hospital stay, prior antimicrobial therapy and co-morbid conditions.[2] Knowledge of causative organisms and their antibiotic susceptibility is crucial for diagnosis of VAP in order to initiate the appropriate antibiotic treatment thereby reducing the adverse effects of inadequate antibiotic treatment on the patient prognosis.[3] Hence, the present study was conducted to isolate and identify the causative organisms of VAP in ICU patients and also their resistance pattern.

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MATERIAL AND METHODS

A prospective observational study was conducted in the Department of Microbiology in association with ICU of our institute from July 2009 to June 2010. The approval of the institutional review board was obtained during the planning phase of the study and each patient gave informed consent prior to participation in the study. All patients on mechanical ventilation for more than 48 hours were included in the study. The diagnosis of VAP was established using clinical pulmonary infection score (CPIS), which was evaluated on a daily basis until the patient was on ventilator support. CPIS of greater than six was used as diagnostic criteria for VAP.4 Clinically diagnosed VAP were observed and clinical parameters were recorded from their medical records and bedside charts. All patients with clinical and radiological signs suggestive of pneumonia on admission were excluded. Under strict aseptic precautions endotracheal aspirate was collected by using suction catheter for adults. Suction catheter was gently introduced through the endotracheal tube, gentle aspiration was then performed and the catheter was withdrawn from the endotracheal tube. Endotracheal aspirate was collected under aseptic precautions after 48 hours of intubation whenever patient was suspected to have developed VAP in ICU and was immediately taken to the laboratory for processing. The samples were first subjected to Gram's staining and then quantitative cultures were performed. All samples were plated on MacConkey agar (MAC), Blood agar (BA), Chocolate agar (CA) and Saboraud's dextrose agar (SDA) (Hi-media, Mumbai, India). Plates were incubated overnight at 37°C and SDA plate was kept at room temperature. All plates were checked for growth overnight and then after 24 and 48 hours of incubation. SDA plates were checked for any growth up to one week. Antimicrobial susceptibility was determined by the Kirby-Bauer disc diffusion method.

RESULTS

A total of 100 patients, who were on mechanical ventilation for more than 48 hours were included in the study. Out of the 100 cases, VAP was diagnosed in 31 cases. Thus, the incidence of VAP in our study was 31%. The highest percentage of VAP was seen in the age group of 51-60 years (41.9%) followed by 61-70 years (25.8%), 41-50 years (12.9%) (Table1). Males accounted for 21 (67.7%) cases and females 10 (32.2%) cases of VAP.

Table 1: Age wise incidence of ventilator associated pneumonia

Age group	No. of cases	Percentage
18-20 years	01	3.22%
21-30 years	01	3.22%
31-40 years	02	6.45%
41-50 years	04	12.9%
51-60 years	13	41.9%
61-70 years	08	25.8%
71-80 years	02	6.45%

In a total of 31 clinically diagnosed VAP cases, 16 cases (51.6%) showed monomicrobial (one bacterial species in ETA) growth, 08 cases (25.8%) showed polymicrobial (two or more bacterial species in ETA) growth pattern and 07 cases (22.5%) showed no growth. Out of total 24 microorganisms isolated, *Klebsiella pneumoniae* 13 (41.9%) was the most common organism isolated followed by *Acinetobacter spp*. 6 (19.3%), *Pseudomonas aeruginosa* 4 (12.9%). Three (9.6%) Staphylococci were isolated, out of which 2 () were methicillin resistant Staph. aureus (6.45%) (Table 2).

Table 2: Organisms isolated from VAP cases

Isolates	No. of cases	Percentage
Klebsiella pneumoniae	13	41.9%
Acinetobacter spp.	06	19.3%
Pseudomonas aeruginosa	04	12.9%
Coagulase negative Staphylococci	01	3.22%
Methicillin resistant *Staph. aureus*	02	6.45%
Proteus mirabilis	02	6.45%
Candida non-albicans	03	9.67%
Candida albicans	01	3.22%

Out of the 13 *Klebsiella pneumoniae* isolates, 11 (84.6%) isolates of *Klebsiella pneumoniae* were resistant to 3rd generation cephalosporins i.e. Cefotaxime (Ctx), Ceftazidime (Caz) and Piperacillin + tazobactum (PIT). Among the 6 isolates of *Acinetobacter spp*. 4 (33.3%) were resistant to all antibiotics tested in this study whereas 2 were sensitive to colistin. Three *Pseudomonas aeruginosa* strains were resistant to Piperacillin + tazobactum (PIT), Ceftazidime (Caz), Cefepime (Cpm) and Ciprofloxacin (Cip).

Table 3: Resistance pattern of isolates from VAP

	Klebsiella pneumoniae	Acinetobacter spp.	Pseudomonas aeruginosa	Staphylococci	Proteus mirabilis
Ciprofloxacin	13 (100%)	6 (100%)	3 (75%)	2 (66.6%)	2 (100%)
Amikacin	7 (53.8%)	6 (100%)	2 (50%)	1 (33.3%)	1 (50%)
Cefixime	11 (84.6%)	6 (100%)	4 (100%)	2 (66.6%)	2 (100%)
Ceftazidime	11 (84.6%)	6 (100%)	3 (75%)	2 (66.6%)	2 (100%)
Cefepime	8 (61.5%)	6 (100%)	3 (75%)	2 (66.6%)	1 (50%)
Cefotaxime	11 (84.6%)	6 (100%)	4 (100%)	2 (66.6%)	2 (100%)

Cefoxitin	-	-	-	2 (66.6%)	-
Penicillin G	-	-	-	2 (66.6%)	-
Amoxyclav	-	-	-	2 (66.6%)	-
Piperacillin-tazobactam	11 (84.6%)	6 (100%)	3 (75%)	-	2 (100%)
Co-trimoxazole	13 (100%)	6 (100%)	-	3 (100%)	2 (100%)
Imipenem	5 (38.5%)	6 (100%)	1 (25%)	-	0 (0%)
Linezolide	-	-	-	0 (0%)	-
Colistin	0 (0%)	4 (66.6%)	0 (0%)	-	0 (0%)
Vancomycin	-	-	-	0 (0%)	-

DISCUSSION

VAP is an important nosocomial infection in patients on mechanical ventilation in ICUs. Awareness of the microorganisms and their resistance pattern is essential for selecting optimum antimicrobial agent for treatment. In our study, out of the total 100 patients, who were on mechanical ventilation for more than 48 hours 31 were clinically suspected of VAP. The incidence of VAP in our study was 31% which was similar to a study conducted by Jampala *et al*, Shalini *et al* and Rakshit *et al*.[5-7] The highest percentage of VAP was seen in the age group of 51-60 years (41.9%) followed by 61-70 years (25.8%), 41-50 years (12.9%). Dey *et al* study showed that patients of age >30 years are more prone to get VAP.[3] Co-morbid conditions like Type-II Diabetes mellitus (DM), Hypertension (HTN), Chronic obstructive pulmonary disease (COPD) and Alcohol make them more prone for development of VAP. Incidence of VAP was more among males (67.7%) than females (32.2%) similar to the study of Gadani *et al*.[8] A total of 24 isolates were obtained from the endotracheal aspirate of VAP patients in which the commonest bacterial isolate was *Klebsiella pneumoniae* 13 (41.9%) followed by *Acinetobacter spp*. 6 (19.3%), *Pseudomonas aeruginosa* 4 (12.9%). Three Candida non-albicans and one Candida albicans was also isolated. The findings are similar to a study by Set *et al*.[9] *Klebsiella pneumoniae* was also reported as the commonest isolates by Rajshekar *et al*[10] and Krishnamurthy *et al*.[11] In present study, 3 (9.6%) Staphylococci were isolated, out of which 2 (6.4%) were methicillin resistant *Staph. aureus* (6.45%). Krishnamurthy *et al* isolated (18.2%) MRSA strains.[11] Fungal pathogens are not significant agents causing VAP.[4] In our study, 3 Candida non-albicans and one *Candida albicans* was isolated. It is probable that the association between MDR bacteria and Candida colonization was more likely due to shared risk factors than causal association Hamet *et al*.[12] Due to the indiscriminate use of antibiotics in ICU setups, there is a high antibiotic resistance in gram negative pathogens that are resistant to third generation cephalosporins, ciprofloxacin and amikacin. Resistance to carbepenems is on a rise all over the world due to the production of metallo-β-lactamase. Recent studies have shown the increasing incidence of multidrug resistant pathogens among patients with VAP. A study by Dey *et al* showed the increased incidence of MDR organisms in the ICU.[3]

CONCLUSION

This study shows the emergence of MDR *Klebsiella pneumoniae*, *Acinetobacter* spp. and *Pseudomonas aeruginosa*, as potential pathogens causing VAP in our ICU. Hence, we recommend a combined clinical and microbiological prevention strategies such as rational antibiotic therapy, timely surveillance, strict infection control measures.

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